

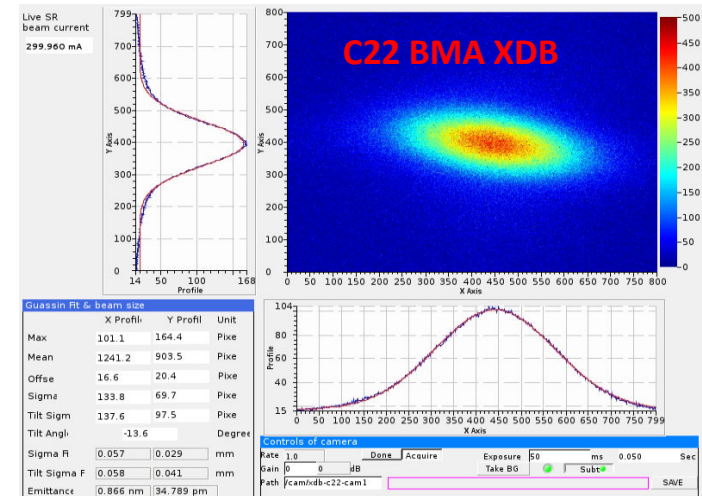
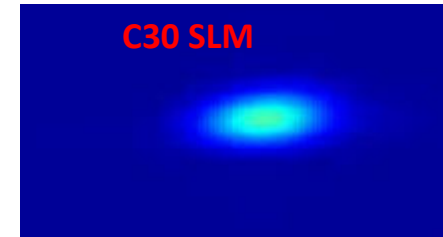
# **Overview of C22 TPW X-ray Pinhole Diagnostic Beamline**

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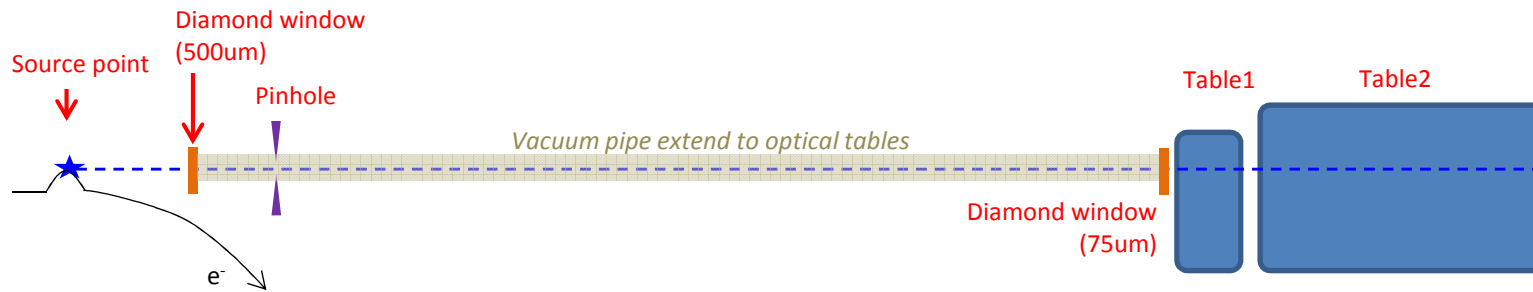
Jul-19-2017, C22 3PW Beamline IRR Review

# Outline

1. Diagnostic beamlines @NSLS-II storage ring
  - Visible SLM (in operation, C30-BMB)
  - X-ray pinhole at 0-dispersion (in operation, C22- BMA)
  - **X-ray pinhole at dispersion (C22-3PW)**
2. Physics measurements
3. X-ray pinhole beamline overview
4. Current Status
5. Beamline commissioning/measurements
6. Summary & future plans



## C22 3PW beamline sketch (Dec-11-2015)



Source point: 3PW @ C22, upstream of BMB

Diamond window: 0.5mm thick, 1mmx5mm aperture, installed

Pinhole: duplicate the BMA design (in vacuum, full retractable to let x-ray fan pass through)

Vacuum pipe will extend to the optical table (75um diamond window at the end).

Table #1 (1ft x 2ft)

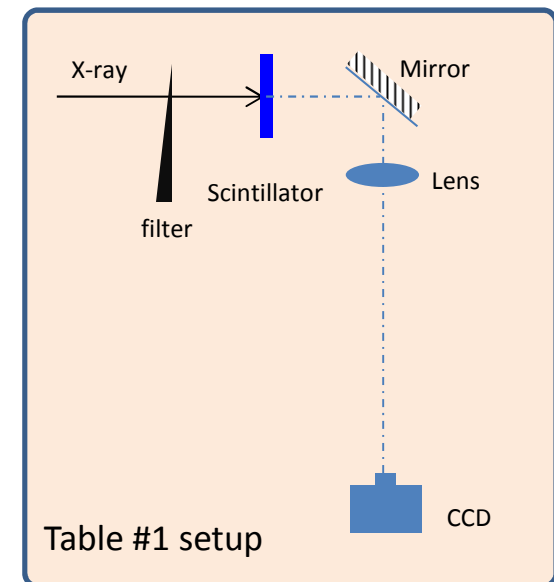
Pinhole imaging system, can be fully retracted to let x-ray through

Optimize the lead shielding to fit on the table

Al filter with various thickness

Table #2 (3ft x 5ft)

Various setups (Peter Siddons)



# Why a second x-ray pinhole @3PW

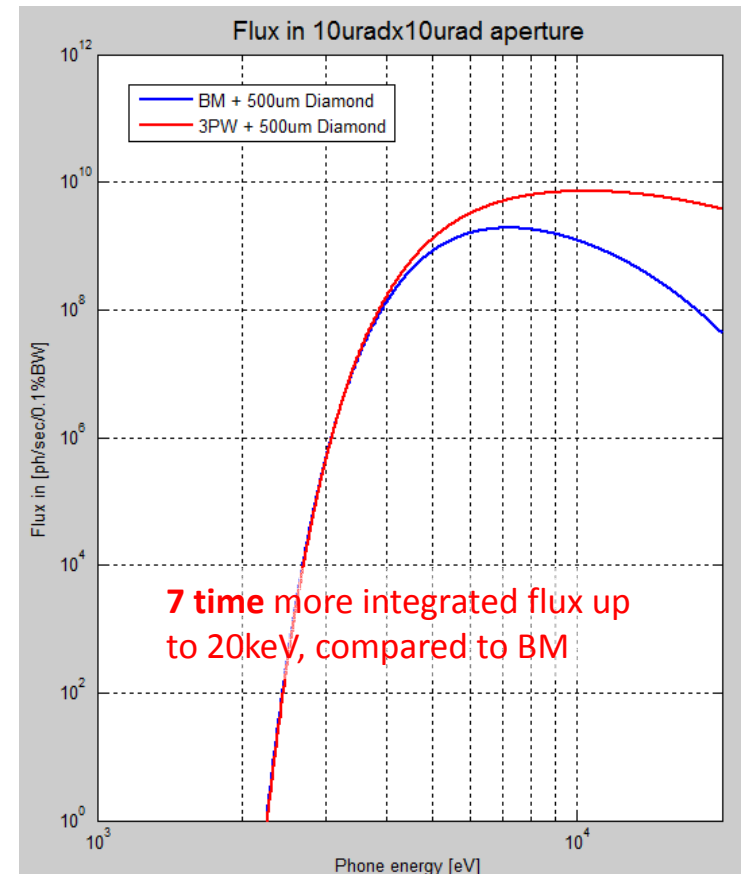
## 1. Emittance and energy spread measurement

$$\sigma_x^2 = \beta_x \varepsilon_x + \left( \eta_x \frac{\Delta E}{E} \right)^2$$

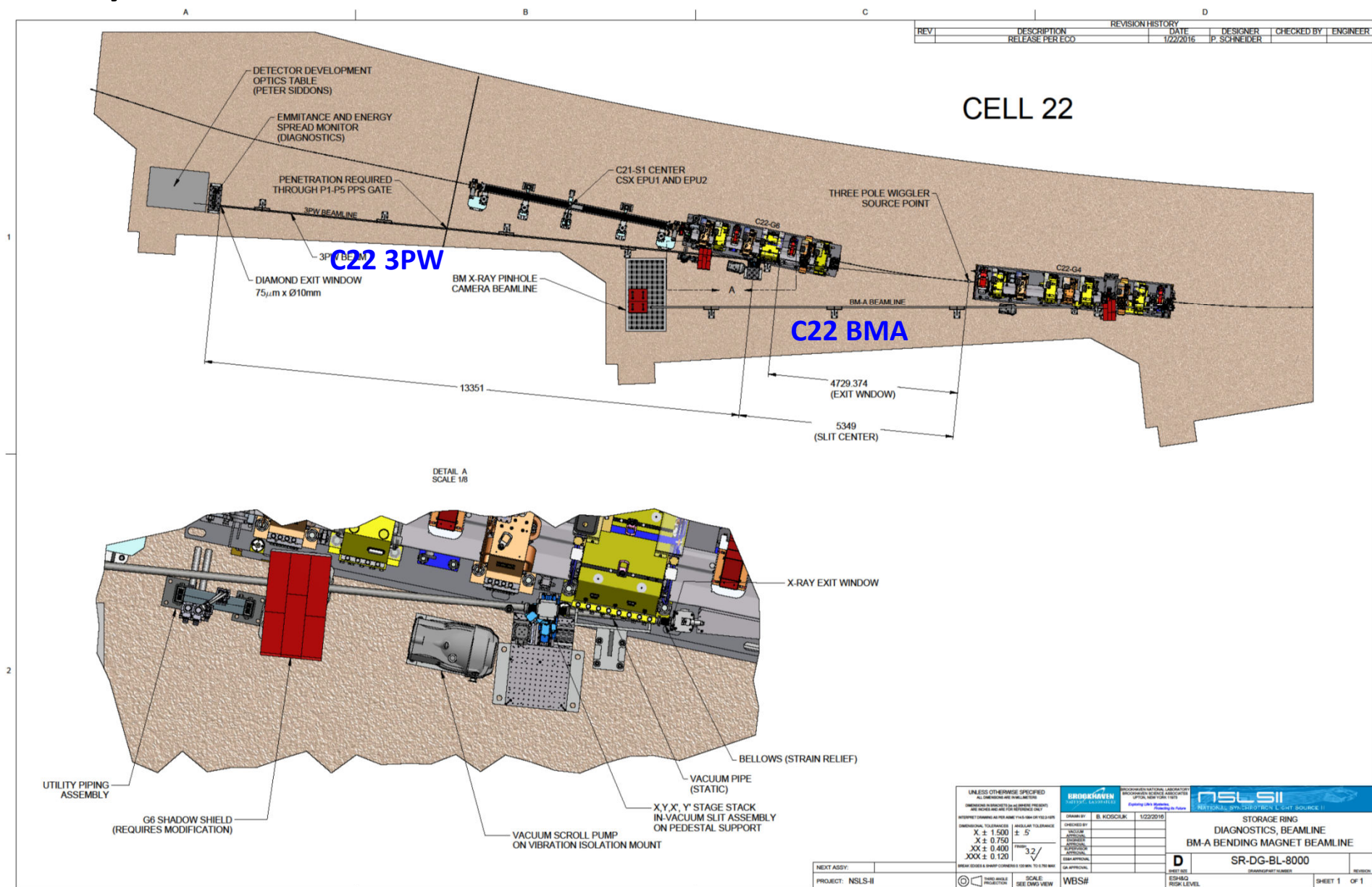
$$\sigma_y^2 = \beta_y \varepsilon_y$$

2. More photons allow precise beam size measurements for low current studies

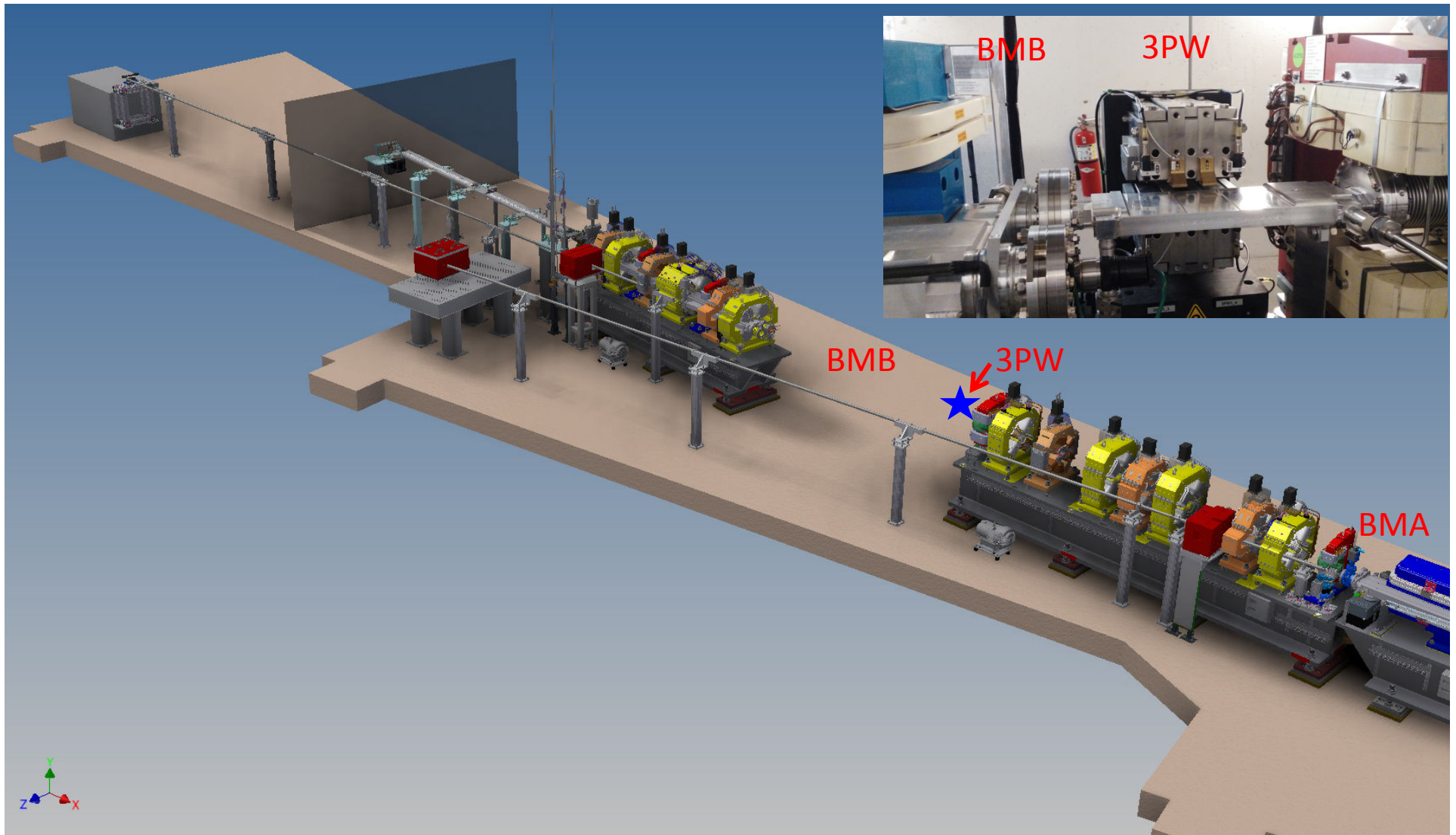
3. Possible to measure turn to turn profile with fast gated camera (future upgrade), which allows fast transient measurement.



# Layout of BM-A and 3PW Beamlines

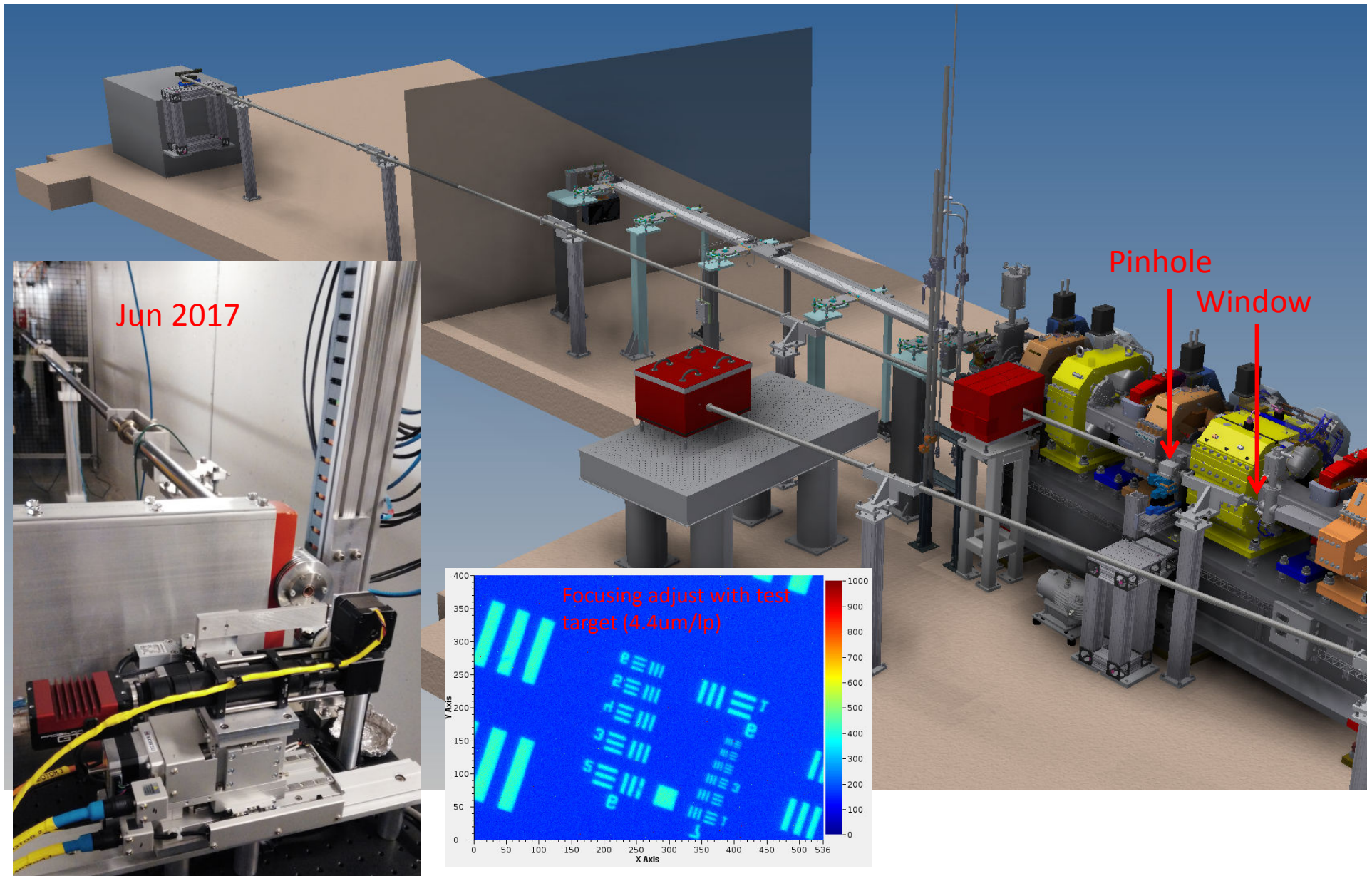


# Layout of BM-A and 3PW Beamlines (cont.)



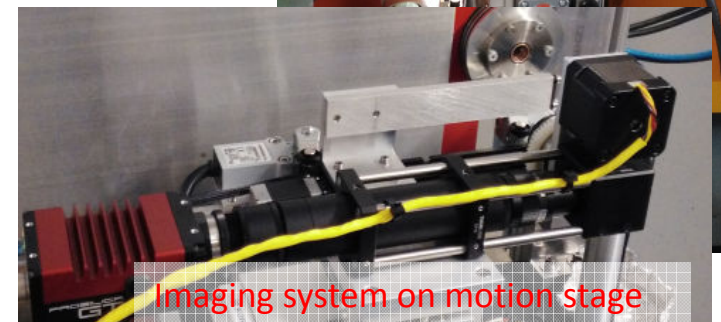
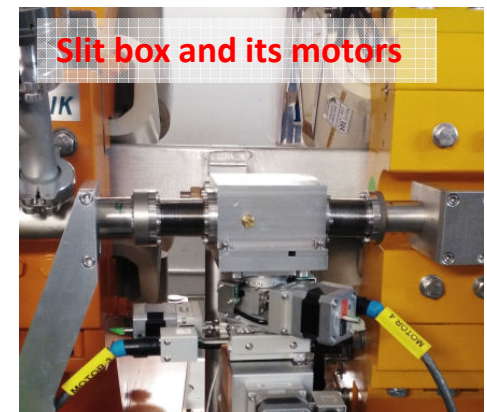


# Layout of BM-A and 3PW Beamlines (cont.)



## Current status of C22 3PW beamline (Jun-2017)

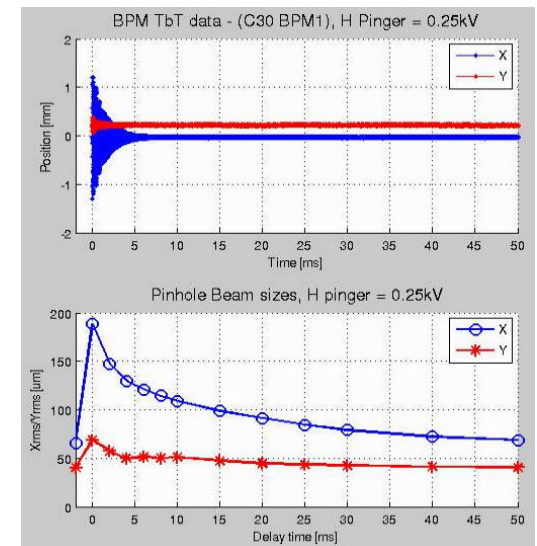
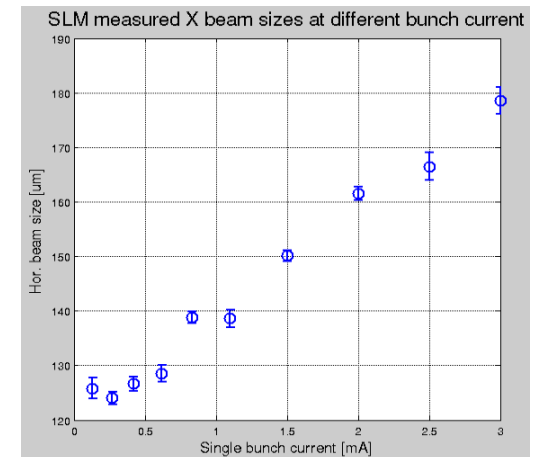
1. 3PW installed (locked at “OUT” location)
2. 0.5mm diamond window installed (separate the ring vacuum)
3. Low vacuum extension pipe installed to the optical tables.
  - 75um diamond window at the end of the extension pipe
  - Glidcop absorber with air cooling right before the 75um diamond window
  - Under vacuum ( $\sim 1\text{E-1 Torr}$ )
4. Pinhole assembly and stages installed and tested
5. Diagnostic optical table installed
  - Imaging system installed and tested
  - Al filter bar installed and tested
  - Focusing motor tested
  - Focus rough adjusted with test target
6. Detector development table in place





# Commissioning plan and early studies

1. 3PW moves in, lattice/orbit correction
2. Search to x-ray radiation from 3PW
3. Align the pinhole
4. Optimize imaging system focusing, filter etc.
5. Check lowest beam current able to be measured
6. Resolution study
7. Measure emittance, energy spread etc.
8. Transient measurement with pulse kicker or injection
9. Other physics measurements



# Summary and future plans

## 1. C22 3PW is ready for commissioning

- 3PW, pinhole, extension pipe, imaging system installed and tested
- Components can be fully retracted for downstream detector developments
- Benefit from the existing BMA pinhole beamline commissioning/operation experiences
- With high photon flux from 3PW, the new pinhole beamline enables several measurements which is not available at BMA.

## 2. Commissioning plan and early studies defined

3. Future development on the 3PW beamline includes a **gated camera** which is capable to measurement turn to turn profile. Bunch to bunch profile measurement is possible with fast response luminescent screen.

## Acknowledgment

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